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VOLUME 6

February, 1928

NUMBER 2

The Extension Pathologist

"TO PROMOTE ECONOMIC CROP PRODUCTION,
IMPROVE THE QUALITY OF THE PRODUCTS, AND
REDUCE WASTAGE IN STORAGE, TRANSIT, AND AT THE MARKET"

THE EXTENSION PATHOLOGIST

Volume 6.

February, 1928.

Number 2.

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WHY SMUT HAS BEEN INCREASING

By E. F. Gaines, Cerealist, Agricultural Experiment Station, and Agent, U. S. Department of Agriculture, Pullman, Washington.

Stinking smut of wheat has increased in the United States rather rapidly since the war. From 1924 to 1927 it has been more destructive and has caused greater losses than stem rust. The estimated loss in 1926 was \$40,000,000. The increase has been especially noticeable in the hard red winter wheat belt. For example, in Kansas the Office of Mycology and Disease Survey of the Bureau of Plant Industry reported only a trace of smut in 1923. Their estimate in 1926 was ten per cent of the entire crop. Only slightly smaller increases were reported for Colorado and Nebraska. Eighty per cent of the wheat of these three States belongs to the hard red winter group.

The increase in smut in the soft red winter wheat States is almost as striking. The same office reported one per cent or less of smut in Pennsylvania and Virginia in 1923, but in 1926 their estimate was between five and six per cent of the crop.

Very little smut had come to the terminal at Minneapolis until recently, but during the last five years it has increased until this year twenty-four per cent of the cars of durum wheat received at Minneapolis were classed as smutty.

The report of the Bureau of Agricultural Economics on the number of cars shipped to various terminals which graded smutty check up very nicely on the estimate of the Disease Survey. Taking the average of the past five years of cars coming to Kansas City, Omaha, Baltimore and Philadelphia which graded smutty, the percentage runs as follows: 12%, 16%, 23%, 26% and 28%. Thus it will be seen that the amount of smutty wheat coming into these terminals has more than doubled during the past five years. In fact the terminal elevators are generally installing washing machinery to clean this large amount of affected wheat.

The Pacific coast area which has long been known as one of the worst sections of the world for smutty wheat has shown a slight decrease during the same five years. Averaging the shipments from Astoria, Los Angeles, Portland, Seattle and Tacoma, the percentage of smutty cars is as follows: 39%, 47%, 27%, 36%, 33%. The reason for this may be explained from the fact that seed treatment is almost universally practiced and a new variety of wheat that is very resistant to smut has been introduced.

The Reason for the Increase

Until recently an explanation was sought from the fact that the farmers of the central and eastern States were sowing their crop

one or two weeks later on account of the Hessian fly. It was also claimed that with the decline of prices in wheat, farmers were neglecting to treat the seed. The agronomists of the Western States who had been doing intensive work on the smut problem discovered this year unmistakable evidence that new supervirulent forms of the smut fungus were present in this country. This conclusion was reached individually in Montana, Oregon and Washington. In Montana a new form of Tilletia levis was used on some smut tests that infected the hard red winter group of wheats to the extent of between eighty to ninety per cent. The old form of levis could seldom be induced to destroy more than ten to fifteen per cent of the crop. At the Lind substation in Washington a form of T. levis produced seventy-five per cent of smut on a formerly highly resistant strain of Turkey. At Waterville, Washington, a farmer lost fifty per cent of his Karkoff wheat with a strain of T. levis in an area where T. tritici had formerly been the prevailing species of smut. At Moro, Oregon, a supervirulent strain of T. tritici was obtained from a Portland office which not only attacked the Turkey wheat varieties severely, but produced from seven to fifty per cent of smutted heads on wheat that had formerly been practically smut free. At Pullman, Washington, a new form of T. levis was found affecting a field of Albit, a new club variety that is immune to the T. tritici that has been the predominating smut of the Palouse.

With this positive evidence of the new forms coming in and with the additional information that such forms have existed in Europe for some time and with the additional knowledge that there was a great exchange in seed grain during and immediately following the war, it should not be surprising if subsequent experiments show that the increase in the hard red winter wheat belt and in the soft red winter wheat belt of the eastern part of the United States, as well as the prevalence of smut in the durum wheat of the Dakotas and Minnesota is due to new physiologic forms of smut that were not present in the United States before the war.

The Remedy

The present smut situation calls for vigorous and concerted action at once. A greatly enlarged breeding program for smut resistance should be inaugurated in which special emphasis is laid on producing varieties immune or highly resistant to the new forms of smut as well as meeting the climatic requirements of the particular section of the country for which it is developed. In the developing of such varieties, large numbers will need to be handled in order to satisfy the requirements of yield, milling, quality, and other factors that go into a good commercial wheat. In the meantime, special emphasis should be placed upon careful and universal seed treatment, and cultural practices should be modified to assist in controlling this most serious wheat disease in the United States.

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CLEANING UP ON WHEAT SMUT

By J. Earl Coke, Ass't.
County Agent, San Luis Obispo
County, California.

Copper Carbonate Treating and Recleaning Machine Successful.

The Grain Department of the San Luis Obispo County Farm Bureau has, for two seasons, operated a copper carbonate treating and recleaning machine which has gone from ranch to ranch cleaning and treating seed grain for the farmers, at cost. This project has been highly successful and has done much, not only to reduce the amount of smut and foul seeds in grain, but to assist in creating additional interest in Farm Bureau work.

The first season the machine operated, a fanning mill and truck were rented, an engine and copper carbonate duster purchased, and a man hired to take this equipment from ranch to ranch. It was necessary during that season to remove the equipment from the truck at each place. As the work was started late in the season, it only operated 33 days, treating 214 tons of grain.

Equipment Used

This season, the Farm Bureau committee in charge of the work, borrowed \$650.00 from the bank, purchased a triple capacity Carter disc recleaner, a new 3 H.P. engine, two steel wagon box elevators, reconditioned the dusting machine used last year, rented a truck, hired a man and started work. The mounting of this equipment on the truck was no easy task, as each detail of construction had to be worked out. In this work, however, the committee was given much assistance by Geo. P. Bodnar, Specialist in Grain Marketing, United States Department of Agriculture. The recleaning machine is set foremost on the truck behind the cab, the duster next and the engine in the rear. A direct drive from both fly wheels operates the recleaner and duster, while the power for the elevators, which are hooked on a pivot close to the recleaner, is taken from the recleaner. The total equipment cost about \$650.00.

Cost of Cleaning and Treating Low.

The usual procedure for the equipment is about like this: the operator of the equipment, who is paid for his work and truck by the tons of grain handled, gets his schedule of work from committeemen in each Farm Center. After receiving this schedule, he moves to

a ranch and sets up the equipment. A charge of \$2.55 a ton is made to the farmer for recleaning and dusting, and \$2.00 a ton for recleaning only. In addition to this cost, the owner pays for the copper carbonate dust used, which amounts to about 90¢ per ton. A quantity of dust is carried on the machine and is sold to the farmer nearly at cost. As the dust is purchased by the Farm Bureau in large quantities for this work, it has been possible to save the grower from three to five cents a pound. This operation takes about 20 minutes, as it is necessary to pull the elevator from a horizontal position, in which position it rides during transit, to a vertical position for work; to slip on the one sack grain receiving bin; to put on the belts, jack up the car. The operator's job is to see that the machine works properly, watch the dust supply and keep the machine supplied with grain.

The farmer supplies a man to sew the sacks of treated grain and take them away.

Cleaning and Treating a Continuous Operation

From the supply bin, the grain is elevated to the receiving hopper of the recleaner. It then goes over a scalper through an aspirator and into the bin containing the discs. The first set of discs throw the wheat into a trough and tails out some barley and other chaff. The first part of the second set of discs separates the cracked grain and small weed seeds, while the other discs continue to pick out the good grain. It is then spouted through the bed of the truck into the second elevator and from there, it is taken to the copper carbonate duster. This machine, which is a continuous operating drum with automatic dust feed, thoroughly coats the wheat with copper carbonate after which it is sacked.

Copper carbonate dust has caused some bother to the operator, but this difficulty is being overcome.

This Work Popular

One thousand thirty-one tons have been handled by the machine this season, (1927), operating about 77 days. This high tonnage was made possible because of the long hours put in by the operator and the cooperation received from the grower. Everyone is well pleased with the work because of its ability to remove wild oats and barley from the seed wheat and give a "hand-picked" separation.

Three-fifths of the total grain acreage in San Luis Obispo County will next year be practically free from smut, and freer from foreign weeds because of the work of this machine. It is impossible to estimate the value of such community work.

Also, it may be of interest to know that last year 38¢ a ton was returned to the farmer above all operating expenses that this year, after paying wages, rent and heavy depreciation on equipment, a larger refund will be possible.

Therefore, as a means of better smut control, of cleaner seed grain, of cheaper costs and of a community endeavor, the project is a success.

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SAN LUIS OBISPO COUNTY SHOWS THE WAY

The farmers in all the grain-growing districts of California are very much interested in the work of the Grain Department of the San Luis Obispo County Farm Bureau in the matter of recleaning and treating their seed wheat with copper carbonate. At least one other itinerant recleaning and treating machine patterned after the one described above by Mr. Coke operated in one of the northern counties of California during the fall of 1927. Other Farm Bureau centers have expressed their intention of operating similar machines next year. At present it seems certain that within a few years every grain-growing center in the State will be operating one or more of these machines.

It is impossible to estimate the value of this project started by the Grain Department of the San Luis Obispo County Farm Bureau. At present these farmers are having their grain recleaned and treated at a nominal cost. This not only stimulates the use of copper carbonate for the control of bunt but encourages the more general use of recleaned seed wheat which in itself is very valuable. Finally, the use of recleaned seed is stimulating a desire on the part of many farmers for pure seed which should add materially to their success as a grain farmer.

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California Agricultural Experiment
Station.

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And while work has been going on in the West, the East has not been idle. In a future number we will hear of the year's work in Pennsylvania, Virginia and Delaware. The following brief report from Maryland is encouraging.

F. C. M.

WHEAT SMUT CONTROL CAMPAIGN IN MARYLAND

By R. A. Jehle, Extension
Plant Pathologist, Maryland.

The campaign for the control of stinking smut of wheat which was begun last year was continued, in cooperation with the Agronomy Specialist. A survey of the important wheat growing regions of the State was made and it was found that the amount of smut was much greater in 1927 than it was in 1926. In 1926 only 15% of the fields inspected had more than one per cent of the heads infected with stinking smut, and 72% had only a trace or none; whereas in 1927 forty per cent of the fields inspected had one per cent or more and only 44% had a trace or none. These results were borne out by millers and shippers of wheat. The millers were more strict in handling smutty wheat and in many cases refused to accept it at all, or offered a much reduced price. This made the demand for seed treatment greater than last year. The demonstrations on seed treatment conducted last year were inspected, also. In these demonstrations the 20 per cent dust was used. It will be noted that in 82% of the treated fields only a trace of smut was found but that one per cent or more was found in 18% of these fields. In most cases when one per cent or more of smut was found in the treated fields, either very smutty wheat was used or the treatment was not thorough. Most of the growers who treated their seed were very well pleased with their results.

Exhibits on stinking smut were prepared in cooperation with the Extension Pathologist, U. S. Department of Agriculture, for fairs at Timonium, Rockville, Cambridge and La Plata, and the treatment of seed wheat was demonstrated at these exhibits. Many demonstrations on the treatment of seed wheat were conducted by the specialists in agronomy and pathology in various parts of the State. Posters were prepared and circulars and mimeographed material were distributed. The accompanying summary prepared by the county agents indicates the extent of this wheat seed treatment campaign.

No. of field meetings:	Oldenburg	60
	Jehle and Hunter . . .	23
	County Agents	35
	Total	118
Bushels of wheat treated	203,633	
Lbs. of dust used	29,011	
No. of homemade machines	459	
" " commercial "	14	
Articles written	152	
Literature distributed	13,300	
Other work done	14	

SOME ASPECTS OF PLANT PATHOLOGY IN EAST CHINA

By R. H. Porter, Extension
Plant Pathologist, Iowa State College
of Agriculture.

In 1923 the writer accepted the position of plant pathologist to the College of Agriculture and Forestry of the University of Nanking and reached that city in September of the same year. At that time there were only two institutions of higher learning in China, where any experimental or research work in plant pathology or mycology was being undertaken. In each case the work was under the direction of Chinese young men whose training had been largely in mycology.

Plant Diseases Important in China, an Agricultural Country.

China is a country as large as the United States but with a population nearly four times as great. Her most important industry is agriculture for approximately 85 per cent of her people are classed as rural. In east and north China the major crops are wheat, rice, grain sorghum (kaoliang), cotton, soybeans, barley, millet, corn and brood beans (*Vicia faba*). Vegetables of all kinds and such fruits as citrus, pears, peaches, persimmons, apples and grapes are grown very extensively.

The country is very rough over a large portion of the area and as a result the people live in the fertile river valleys and on the plains. This condition makes the population very dense in spots with the result that the average sized farm is estimated at between 4 and 5 acres of tillable land per family of 5 or more. It is very important because of this situation in agriculture that every spot of tillable land be cultivated and made to produce the maximum. One important limiting factor in crop production in north China is lack of sufficient rainfall during the growing season. Another factor is lack of fertilizers in sufficient quantity but again, in north China the decomposition of organic materials is dependent on the availability of moisture. A third factor and one which is neither understood nor seriously considered is the loss from crop diseases. The Chinese farmers know nothing of the nature of plant diseases, they merely attribute them to the god of the weather.

Plant Disease Survey in China

In the fall of 1923 and again in the early spring of 1924 intensive surveys in the vicinity of Nanking were undertaken to determine what crop diseases were of importance. These surveys were later extended into North China to include a total of 7 provinces. As a result a better understanding of crops and diseases was secured. This formed the basis of all the experimental work which was carried on. A complete list of all

the fungi collected in China by our department is in preparation and I hope will be available very soon.

The diseases of importance on the major crops are as follows:

Wheat: Loose smut, flag smut, stinking smut, black stem rust, orange leaf rust, yellow stripe rust and powdery mildew.

Barley: Covered and loose smut, stripe, net blotch, dwarf leaf rust, black stem rust and powdery mildew.

Kaoliang: Loose and covered kernel smut, head smut, anthracnose (*Colletotrichum lineola*) *Cercospora* leaf spot, leaf stripe (*Septoria pertusa*) and an important disease on the glumes and kernels caused by a species of *Phoma*.

Millet: Kernel smut, downy mildew, leaf rust (*Uromyces leptoderma*) *Helminthosporium* leaf spot and a disease of the glumes caused by a species of *Phoma*.

Rice: Stinking smut, green smut, and blast.

Corn: Smut, brown leaf spot, (*Physoderma Zeae maydis*), *Helminthosporium* stripe and leaf spot, *Diplodia* dry rot and *Basisporium* dry rot.

The diseases of fruits and vegetables are quite similar to those found in the United States. Over a period of years the total loss from crop diseases in China is quite significant and is certainly one of the important contributing factors to famines. Control of preventable diseases in China is one of the most effective methods of bringing about an immediate increase in returns to Chinese farmers.

Cereal Diseases Investigated

The major portion of the experimental work during the period of 1923 to 1927 was concerned with cereal diseases. The smuts occupied most of our attention. The work was divided into two types, (1) Immediate relief by seed treatment tests and (2) Disease resistance tests using individual plant selections and varieties.

Briefly our projects included the following studies.

I. Seed treatment experiments with chemical dusts on wheat, barley, Kaoliang and millet for the control of loose and flag smut of wheat, covered smut and stripe of barley, loose and covered kernel smuts of Kaoliang, anthracnose of Kaoliang and kernel smut of millet. Considerable progress was made on all of these crops and two papers are now in preparation, one on barley, the other on millet.

II. Disease resistance tests by seed inoculation on all of the above crops for flag smut, covered smut and stripe of barley, smuts of Kaoliang and millet. A number of millet selections failed to show infection for two successive years and many wheat varieties both from China and the United States appeared resistant to flag smut. One interesting thing was that varieties resistant in Illinois were in general equally

resistant in China. Progress was made with smut resistant selections of Kaoliang and also with barley.

III. Field tests were made for three years with over 550 wheat varieties and for one year with 800 plant selections for their reaction to orange leaf rust and stripe rust. The latter is a very destructive rust on wheat and it was found that under field conditions there was a wide difference in the relative susceptibility to both these rusts. Breeding for resistant varieties of cereals is one of the most needed lines of investigation in China.

In addition to the experimental work our section was responsible for the teaching work in plant pathology and plant physiology. Also graduate work was begun with two young Chinese students registered for masters' degrees. Both these men are on the job now, continuing the experimental work.

War Interrupts Work

The unsettled political conditions made it impossible to remain longer in China. On March 24th the southern army entered Nanking, killed 6 foreigners, one of whom was the Vice-president of our University, threatened many more and completely looted every foreign home in the city. For about 30 hours 150 foreigners were imprisoned in the Agricultural building and it was extremely doubtful whether any would get away alive. Through the intercession of the American Naval authorities we were finally released and taken to Shanghai. Most Americans returned to the United States although some are awaiting a settled condition in order to return.

Opportunities for Future Research

The possibilities of development and improvement in China are tremendous in all fields. China needs western science and learning as well as guidance in her overwhelming problems. The opportunities in agriculture are beyond description and especially in the field of the botanical sciences because the Chinese eat more products directly from the soil than from animals. Crop improvement by breeding for better varieties and by disease control will occupy a very important place in the development of Chinese agriculture. Very close relations are still maintained with the section of plant pathology at Nanking by the writer in the hope that the experimental work may be continued and enlarged and more young men become inspired to make plant pathology a life profession. In the final analysis China's problems must be solved by her own people.

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NEWS FROM THE STATES

In future issues this space will be used for notes, preferably not more than 100 words in length from State workers. A mimeographed reminder will be sent out on the first of each month. Material received by the 15th of one month will be included in the issue of the next month.

Maryland.

While in California on annual leave I visited officials of the State Department of Agriculture, Experiment Station and Extension Service, as well as representatives of several bean seed producing companies. One of the seed companies agreed to grow plots of string beans, and lima beans under careful supervision, using varieties commonly used for canning and for market in Maryland. Officials of the State Department of Agriculture, Extension Service and Experiment Station agreed to cooperate in the work. Seed from these plots will then be sent to Maryland and accurate records of its performance will be kept. It is hoped that this will lead to bean seed certification in California and better seed for Maryland farmers.

R. A. Jehle, Extension Plant
Pathologist, Maryland.

Articles, news notes, or suggestions with regard to subjects that might profitably be discussed in this news sheet, should be addressed to:

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Washington, D. C.

